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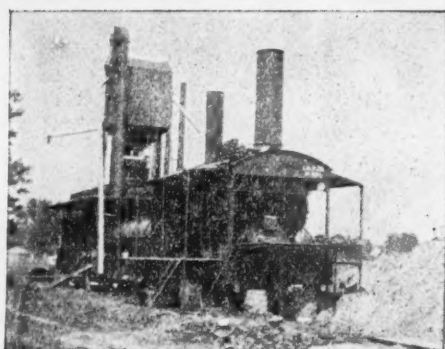
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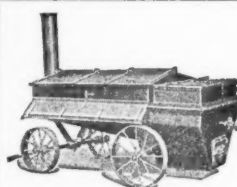
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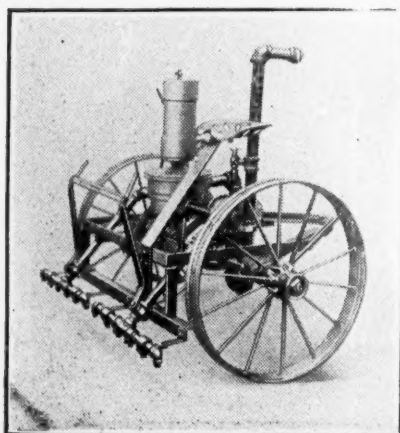
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LET 1920 ROAD CONTRACTS NOW

As explained elsewhere in this issue, the amount of money
available for construction of hard-surface roads next year will
be unlimited. The limiting conditions will be the amounts of
labor and materials available, including the ability to get the
materials onto the ground.

From the middle of February to the middle of April, this
year, more than 250,000 open-top cars, such as are used for
hauling road materials, were standing idle, and this has been a
more or less common experience in the past. If only these cars
could be used next spring for hauling road material, prepara-
tory to the year's construction, the total amount of highway
improvement that can be performed would be greatly in-
creased.

As for labor, while there is not so much urgency in ad-
vance preparation, still, contractors require some time to or-
ganize their forces and especially to secure the necessary ex-
perienced foremen, and the sooner they can be certain of the
amount of next year's work, the better their chances of per-
fecting an adequate organization.

This means that by the middle of February contractors
should be able to place their orders for materials and make
their preparations for the season's work. This, in turn, in-
volves the letting of contracts during December or January.

The city, county or state which delays later than February
to let contracts for next season's road work is likely to find
itself unable to complete, next year, anything like the amount
of work that it may desire. Preparing plans and specifications,
making estimates, advertising for bids and awarding contracts
each requires some time, and the few weeks between now and
February is none too long a time for properly completing these
preliminaries to construction.

Plans for 1920 road work should be begun at once and put
through without interruption.

WATER WASTE PREVENTION SHOULD BE CONTINUOUS.

The elimination of waste of water, like liberty, can be
maintained only by eternal vigilance. An occasional campaign
for discovering leaks and discouraging waste may be effective
for the time being, but the effect quickly vanishes. Pipes that
have continued sound for years suddenly break for no as-
certainable reason, old joints begin leaking, and the natural
deterioration of house plumbing and the other appurtenances
of a distribution system, aided generally by carelessness or ig-
norance of consumers, insures continual recurrence of leaks in
various parts of the system. This being the case, the only
preventive of waste is a continuous, organized survey of the
entire system to insure that new leaks shall be discovered and
stopped in a minimum of time.

There are few systems therefore, in which it cannot be

demonstrated that one of the most important duties of the superintendent is continuous vigilance to keep leakage and waste at a minimum. In stopping waste he not only saves a considerable amount of water (this may at present be so abundant that saving it offers no inducement), but he postpones the time when it will be necessary to increase the size of mains, reservoirs and other features of the plant, and he immediately increases the pressure and the amount available

for fires, which additional fire protection is a valuable and continuing benefit to the community.

In this issue will be found an interesting description of the experience of Washington, D. C., in continuous water waste elimination during a period of thirteen years—a service performed by a regular organization which has saved its cost many times over in the amount of waste and leakage which it has discovered and stopped.

WATER WASTE PREVENTION SURVEYS IN WASHINGTON.

Have Saved a Waste of Forty-five Million Gallons Daily—Description of Plan and Organization by Which This Has Been Effected During Thirteen Years of Continuous Investigation.

By PAUL LANHAM, Engineer in Charge of Division of Water Survey.

A few months ago, as part of a series of articles on "Water Works Operation," we published descriptions of methods for preventing waste of water, giving prominent place to the making of systematic surveys of the distribution system by districts. Washington, D. C., was among the first cities to make a complete and thorough survey of this kind and establish a permanent organization for continuing the work, and its experience and records along this line are not, we believe, surpassed or even equaled by those of any other city. During the past 13 years it has located and stopped 45,000,000 gallons daily of waste. Paul Lanham, the engineer in charge of this work, described the method of operation and some of the results obtained in a paper before the recent convention of the New England Water Works Association. This paper is given below.

Systems of water waste prevention surveys as applied in the various cities and by the private companies engaged in that class of work are basically the same. That is, the old Deacon system of English origin, with its division of the distributing mains into districts and the more or less complete analysis of the total flow affords the foundation upon which have been constructed the somewhat elaborate and thorough detailed system of the present day.

Two branches of work naturally form the complete system. First must be determined the necessity for the surveys, as indicated by the total consumption and per capita data for the whole plant, which must then be divided and separate determination made as to which sections or districts of the city are in condition demanding attention. After this of course follow the detailed surveys within these sections, by which the actual location and causes of the abnormal or wasteful conditions are determined.

DISTRICT SURVEYS.

The first and probably most important step in starting a water survey of a city distribution system is the proper division of the mains into permanent districts. This necessitates a thorough study of the general layout and some knowledge of the direction and rates of flow in the different trunk mains. These latter facts can be easily determined by using portable pitot tube apparatus at various points. In selecting boundaries for the various permanent districts, it must be borne in mind that measureable velocities are necessary at the proposed district measuring points, that valve closures must be made at neutral or nearly neutral flow-points to avoid serious interference with pressure and supply, that subsequent work makes the segregation of like consumers in the same district not only desirable but almost necessary, that ample capacity must be provided in mains feeding the district when other mains are closed off during the measuring periods, and that the districts must be of such size as to permit a complete detailed survey within a period of one or two months to avoid confusion of data due to changes of season while the work is in progress.

These conditions cannot of course be secured fully in all cases. High and low service areas interfere, some sections have natural boundaries which must be followed regardless of the dictates of the system, and intermixtures of factories with residences in many cases produce undesirable conditions. Permanent boundaries, however, must be established as near as possible in conformation with the plan, and must thereafter be maintained permanent to avoid rendering useless for comparative purposes data previously secured.

Measurement of district flow should be made at as frequent intervals as possible. It would be ideal to maintain permanent recording instruments at the measuring points and keep constant record of the flow condition. This is impractical because of the extra fire hazard and other risks involved in maintaining a great number of closed valves throughout the system. From four to six measurements of at least seven days duration should be made, if possible, of the flow into each district each year. Portable recording pitot apparatus, which MUST be used upon the detailed flow analysis within each district, is ideally adapted to these measurements and its use for both purposes simplifies the equipment considerably. These measurements give mean daily consumption, and maximum, minimum and night rates of flow. Population count made by the inspectors while making the detailed surveys within the districts permits the district per capita rates to be determined. The per capita rate and the ratio of the night rate to the mean daily rate of flow are excellent indices of the condition of the district. Of course, consideration must be given to the character of the consumption when reaching conclusions based upon these figures. To facilitate this, a census of buildings also is taken during the progress of the detailed surveys and this together with all other data must be recorded permanently for future reference.

Very interesting facts are frequently brought out by study of the flow charts taken upon the various districts, and their value is limited only by the intelligence of the investigator. Cases on record show districts where the

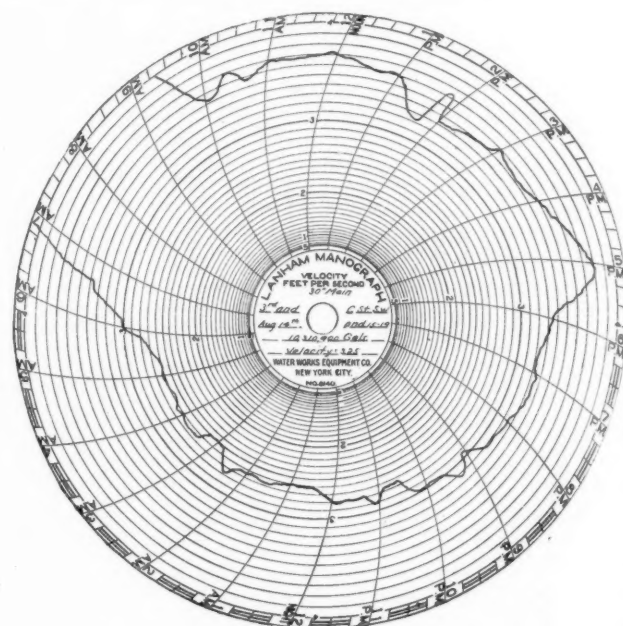


Fig. 1—TYPICAL MANOGRAPH CHART, SHOWING FLOW THROUGH 30-INCH MAIN SUPPLYING A PURELY RESIDENTIAL SECTION.

Note that night rate is about 80% of mean daily rate.

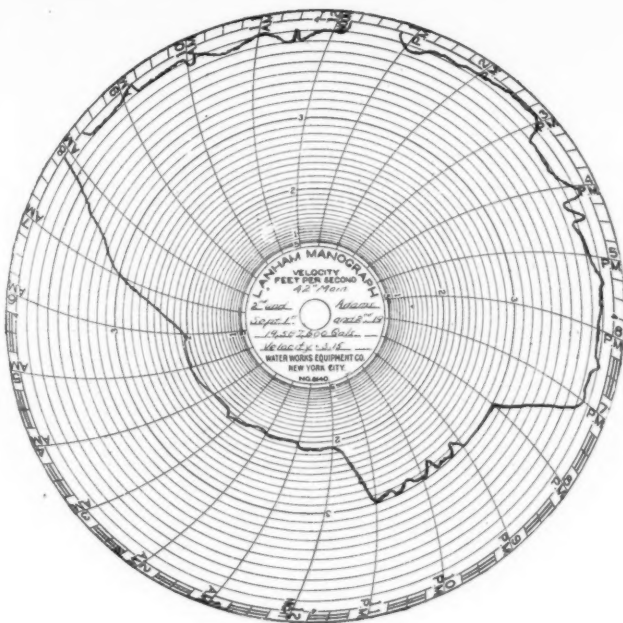


Fig. 2—FLOW CHART, SHOWING RATE THROUGH 42-INCH MAIN.

Note unusual peak during noon hour; also morning peak and rapid decline after supper and after 11 o'clock at night.

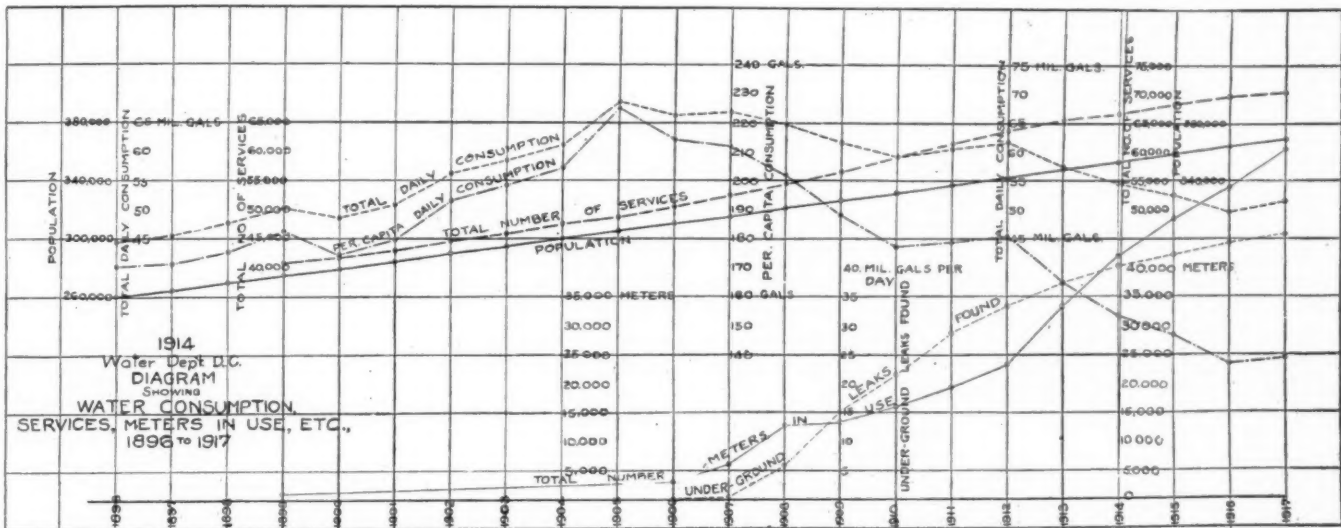


Fig. 4—GRAPHIC CHART, SHOWING METHOD OF RECORDING IMPORTANT DATA BEARING UPON CONDITION OF CITY DISTRIBUTION SYSTEM.

night rate of flow exceeds the rate during the daytime; others show a ratio of night rate to mean daily rate varying from zero to 100 per cent. Charts frequently show abnormally abrupt changes in the flow rate, excessive peak loads indicating over-taxation of certain mains, and many other facts have definite causes and reveal, upon study, all the secrets of the distribution system. Extreme variation in conditions will occur due to variation in usage in industrial plants, seasonal changes and other causes, so that the data obtained must if possible be compared with previous data obtained under like conditions to determine its full import. The illustration No. 1 shows a typical flow chart taken on a 30 inch main supplying a permanent district of almost purely residential nature. Note that the night rate is almost 80 per cent of the mean daily rate.

The illustration No. 2 shows a flow chart from a 42-inch main supplying a large area. Note the usual morning peak load, occurring in this case at 8:00 o'clock. Note also the peak during the noon hour, which is a rather unusual. Rapid decline in rate of flow after 7:00 P. M. and again after 11:00 P. M., give insight into the habits of the

A comparison of conditions immediately before and after a detailed survey is particularly interesting and valuable, and the dates of measurements may advantageously be selected to permit this. The illustration No. 3 shows an index card taken from the files of Washington, D. C. At the top of this card is given the total and per capita consumption. The high percentage of night rate and extremely high per capita consumption both show the necessity for waste investigation. The other figures on the card show the result of the detailed investigation. All flows detected on the night analysis are classified and recorded as shown on the lower part of the card. A second survey was made April 19th to 25th, 1912, about 19 months after the first, in which the following figures were obtained:

Mean daily supply, 6,149,800 gals.; minimum night rate, 4,156,800 gals.; ratio of latter to former, 68%; per capita consumption, 282 gals. Subdivision survey started 8-7-11; finished 4-28-12; cost, \$3,280.26. Resident population metered, 4,783; unmetered, 17,089. Floating population metered, 7,689; unmetered, 7,625; total population metered, 12,471; unmetered, 24,704; total, 37,176. Number of dwellings metered and unmetered, 361 and 3,659 respectively; hotels and apartments, 50 and 17; restaurants, 40 and 6; factories, 14 and 18; municipal buildings, 9 and 8; federal buildings, 4 and 10; miscellaneous, 196 and 558; total buildings, 673 and 4,272.

Total night flow detected by subdivision tests, 2,072,700 gals. per day; of which 388,700 was inside metered premises, 561,600 was inside unmetered premises, 397,500 was due to underground leakage from services, 59,600 from mains, 800 unclassified—a total of 457,900 underground leakage. Municipal consumption was 52,000, federal consumption, 490,500; giving total flow accounted for of 1,953,700 gals. and leaving 119,000 unaccounted for.

In a number of cities, different water service areas supplied directly by individual pumps or by trunk lines, where venturi meters have been installed, constitute natural per-

PITOMETER DISTRICT 1 SURVEY NO. 1				
MEASUREMENT	9/13-19/10	7,638,000	Gals. per day	
Mean daily supply		6,065,400	"	
Minimum night rate		779	"	
Ratio of minimum night rate to mean daily supply		251	"	
Per capita consumption, taken from resident population				
SUBDIVISION SURVEY				
Started				
Finished				
POPULATION				
Resident	METERED	UNMETERED	TOTAL	
4,281	17,460	21,741		
4,039	9,278	13,317		
Total	8,320	27,019	35,339	
BUILDINGS				
Dwellings	427	3,826		
Hotels and apartments	31	43		
Restaurants	36	11		
Factories	22	12		
Municipal buildings	9	1		
Federal buildings	0	6		
Miscellaneous	90	422		
Total	632	4,321		
TOTAL NIGHT FLOW DETECTED BY SUBDIVISION TESTS			9,078,000	Gals. per day
Due to flow inside metered premises		300,500		
Due to flow inside unmetered premises		1,262,000		
Due to underground leakage				
Services	1,070,200			
Mains	173,200			
Unclassified	800			
Due to municipal consumption		3,243,700		
Due to federal consumption		59,200		
TOTAL FLOW ACCOUNTED FOR		411,400		
TOTAL FLOW UNACCOUNTED FOR			2,296,400	

Fig. 3—INDEX CARD SHOWING METHOD OF FILING DATA.

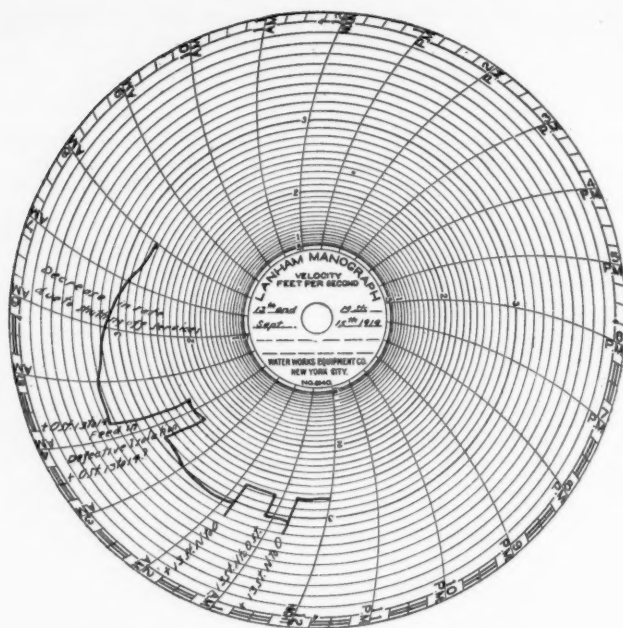


Fig. 5—NIGHT SUBDIVISION TEST CHART.
Showing effect of cutting off different squares for test.

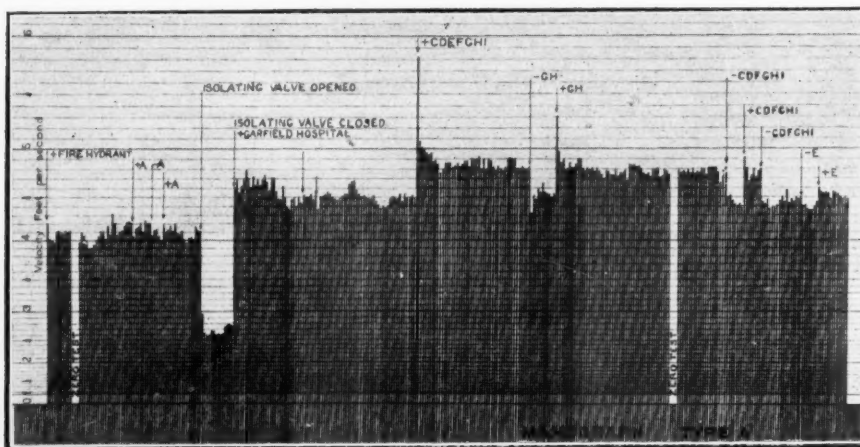


Fig. 6—NIGHT SUBDIVISION TEST CHART TAKEN ON A
TYPE A MANOGRAPH.

manent districts which can be observed at all times by inspection of either the pumping records or the venturi charts. In many cases these natural districts are too large to be properly treated as permanent survey districts but they form convenient units for checking total figures obtained by consolidating the data secured concerning the permanent districts within their limits.

Such data as mean daily consumption, per capita consumption and night rate of flow for the entire city should be plotted constantly as a matter of general interest and value. These figures are usually obtainable from pumping station or filtration plant reports. They form the measure of the effectiveness of the surveys and are indisputable. The graphic chart, illustration No. 4, is the best method of recording these data, as improvement or decline in condition is instantly observed without recourse to figures.

DETAILED SURVEYS.

Detailed surveys within the permanent districts, made for the purpose of ACTUALLY locating and weeding out the wastes and leaks from the legitimate consumption, follow a well defined basic system also, but the degree of thoroughness and success depends greatly upon the limitations of the pipe system in the matter of valves and stop-cocks, and the ability of the operators. Measuring points having been established throughout the permanent district under survey, the portable recording pitot apparatus is

moved from place to place as the work progresses and each section of main is given close examination.

Small temporary test districts are isolated after eleven o'clock at night and the total rate of flow into them observed and recorded on the pitot chart. Work of testing and inspecting is continued through the night until about four o'clock A. M., when it is found that the rate of flow becomes unsteady and interferes with the tests. Tests are made at this time because legitimate consumption is then at a minimum, while leaks and wastes will still be running at full head. In residential sections the rate during these hours is practically 100 per cent illegitimate.

The method of test consists simply of measuring the rate of flow into a limited number of squares and noting either the increase or decrease in this rate caused by altering the number of squares included in the test district. By "square" is meant a section of the main in a given street lying between adjacent intersecting streets. In most cities valves are placed at these points. Of course, the location of valves really determines the extent of the main included in each separate test. To go into detail, assuming a rate of flow of 100,000 gallons per day, for instance, in a test district of two squares, the rate of flow increasing to 110,000 gallons upon the addition of another square indicates of course that the rate of flow into this additional square is 10,000 gallons daily. Reversing the process, the rate would of course drop from 110,000 gallons to 100,000 gallons if the square is excluded from the test district. Both methods of

testing are utilized as conditions require. The method of adding squares is preferable, as it keeps the size of the district under test always at a minimum, thereby facilitating the work by frequently excluding for longer periods undesirable fluctuations in certain squares, also by immediately locating this fluctuation upon its appearance upon the chart coincident with the addition of a square under test, permitting the immediate exclusion of this square to avoid its interference with other tests.

The illustration No. 5, shows a typical chart taken upon a subdivision night test. Note the changes in flow rate occurring coincident with the valve operation. Also note the high momentary rate coinciding with each valve opening due to rapid flow into

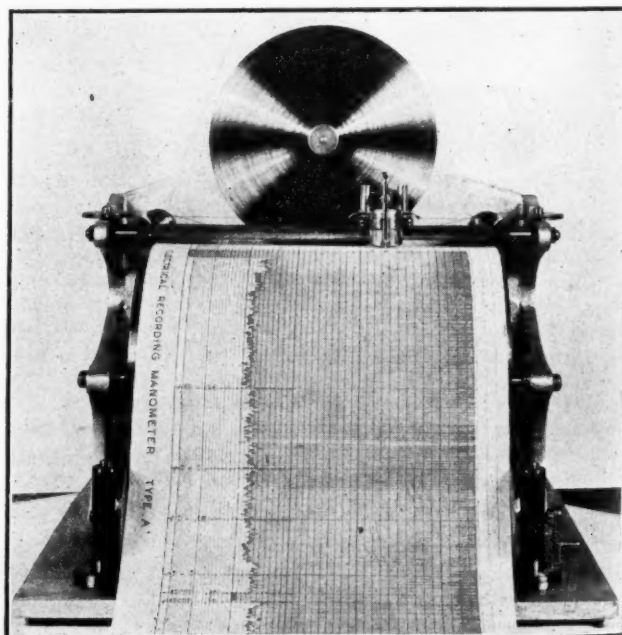


Fig. 7—TYPE A MANOGRAPH.
Special type of pitot recorder used for subdivision tests.

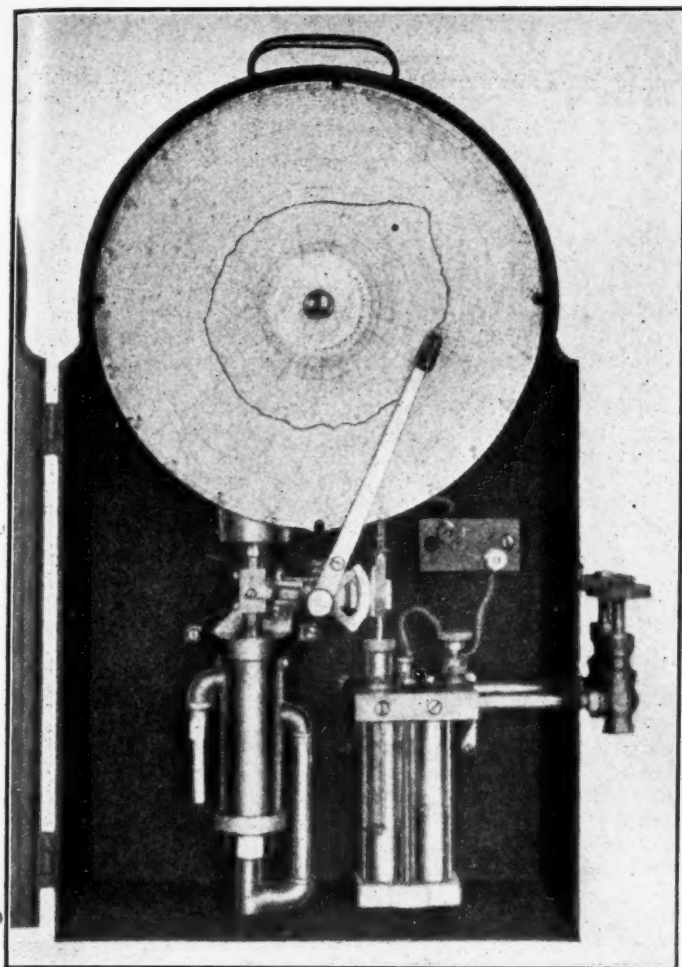


Fig. 8—TYPE B C MANOGRAPH.
Used for all classes of pitot work.

shut off preceeding the test and verifies the existence of a leak or waste in the square.

The illustration No. 6, shows another chart of subdivision night test in residential territory. Note the fluctuation occurring in the rate of flow. Repetition of test and careful observations are necessary to detect small changes in the flow rate. Note how rate of flow dropped when isolation was opened preparatory to extending it to include Garfield Hospital. The usual method in preparing for the addition of a square is to close the valve at the far end first, which cuts off the only remaining feed, test the shut-off by opening fire hydrant or other fixture, and then open the valve at the near end of the square. In cases where the water cannot be cut off, as in the case of Garfield hospital, the near valve is opened first, temporarily destroying the isolation, permitting water to flow into the test district through this opening until the valve at the remote end of the square is closed.

The recording apparatus for this testing work should produce a chart visible at all times, have a rapid chart movement, and be quickly responsive to the smallest changes in rate of flow.

Fig. 7, shows a type of Pitot recorder used for many years in Washington, D. C. It is known as the Manograph Type A and meets the prescribed conditions. Fig. 8, shows a latter type of instrument used in Washington and many other cities in waste-prevention work. It is known as the Manograph Type B. C. It differs from the first illustration only in the character of the chart.

The illustration No. 9, shows method of setting up pitot tube and recorder ready for measuring total flow or making tests. The use of indicators without the chart is not satisfactory, due to the fluctuating rate of flow always occurring, even in residential sections, in the small hours of the morning. The reasons for these fluctuations constitute somewhat of a mystery and they interfere seriously with testing where small flows are involved.

The locating of the night flow first involves the use of all street valves, and when the flow has been definitely determined as to quantity and location within the closest limits permissible with these valves, recourse is had to the aquaphone or water-phone and the operators listen with it on each curb stop-cock, fire hydrant, lawn sprinkler connection, or any other fixtures attached to the main within the pre-determined limits. Examinations are made also of all sewer manholes, large sewers, electric or other ducts, and advantage is taken of every facility to determine the exact location of the flow. Flows due to fixtures or other causes within the houses or buildings are readily determined when the aquaphones are placed against the curb stop-cocks and the operators hear the flow passing through the pipe. If closure of the stop-cock causes stoppage of the sound, this proves that the leak or flow is in the particular service pipe under observation or in the building supplied by it, and the amount is registered by the pitot recorder, being the reduction in rate of flow coincident with the closure of the stop-cock. Flows due to leaks on the mains or on service pipes between the main and curb stops can be heard on the service pipes, but these flows will not be affected by closure of the stop-cocks, nor will any reduction of rate of flow occur at the recorder. The total quantity of flow due to these unaccounted for or so-called "outside" flows may readily be determined by a second test of the entire square with all inside flows shut off at the curb line.

It is frequently necessary to drive test holes down to the mains and service pipes to permit the use of the aquaphone in definitely locating an underground leak within closer limits than provided by the valves, stop-cocks or other fixtures, increasing loudness at the different points indicating that the operator is nearing the leak. Frequently water or mud will be observed on the end of the steel prod used for this purpose and this indication is utilized. Proper use of the aquaphone is really a science and long experience is necessary for one to become expert in its application to the underground leakage problems. The illustration No. 10, shows a field party engaged in prodding for underground leaks, existence of which has been detected by a night subdivision test. The laborer is engaged in driving heavy steel pin through sheet asphalt preparatory to using steel prod and aquaphone. During the progress of the night tests the operator in charge makes notes as to each step in the proceedings and has an instrument tender place an identification mark upon the chart at each point corresponding with the test, signals by lanterns or otherwise being utilized; this greatly facilitates interpretation of the



Fig. 10—EXAMPLES OF LEAKING SERVICE PIPES.

1. Corroded black iron pipe, about twenty-five years old.
- 2 & 3. Defective wiped joint due to poor workmanship, a frequent cause of waste.
- 4 & 5. Lead pipes damaged by freezing.
6. Broken iron pipe. Breaks are more frequently found at elbows and tees than elsewhere.
7. Corroded iron pipe.
8. Defective stop-cock caused by abuse in placing key in operating. Cocks should be of heavy pattern to withstand rough treatment caused by difficulty in placing keys.



Fig. 9—FIELD PARTY OF WATER SURVEY DIVISION PREPARING TO PROD FOR LEAK NOT SHOWING ON SURFACE.

charts, and this system is superior to the time schedule system of testing, in which the time of test is noted to be located on the chart later.

It is apparent from the description given that the basic system is very simple and that by exercises of care and good judgment results should be secured by anyone. The difficulties met with in practice are frequently very discouraging, however, and the getting of results in spite of them taxes the ingenuity of the operators. These difficulties consist of inaccurate maps which fail to show important mains, cross connections, valves and other features vital to the proper isolation of the district and individual squares; inaccessible curb stop-cocks which must be cleaned out at the expense of much labor, broken valves and stop-cocks, leaking valves, obstructed mains, unrecorded cross-connecting service pipes, and fluctuating rates of flow, causing confusion and wrong deductions.

The illustration No. 11, shows samples of underground

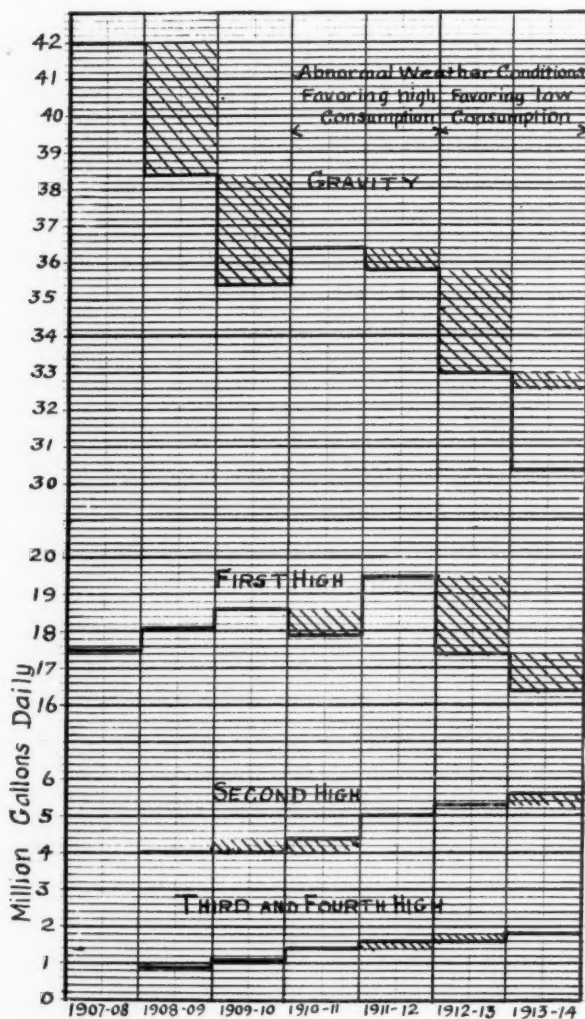


Fig. 11—CHART SHOWING EFFECT OF SURVEY ON DIFFERENT WATER SURVEY AREAS. Lined sections show range of surveys. Note invariable decrease in consumption following surveys, compared to increasing rates at all other times.

breaks found only a few feet below the surface, their presence having been unsuspected until revealed by the tests. Fig. 12, shows in a most convincing manner the aggregate effect of this work in large sections. Note the heavy decrease in consumption coincident with the surveys as compared to invariable increases at other periods.

ORGANIZATION OF FORCE.

The organization of a properly balanced force to efficiently handle the water waste problem is a matter depending considerably upon local condition. In general, the force should be supervised by an experienced engineer, with at least one clerk and one draftsman comprising the over-head organization, and as many field parties as the circumstances demand. Each field party should consist of a chief operator and two or more inspectors, with necessary laboring force to clean out stop-cock boxes, open necessary excavations, operate valves and perform other necessary miscellaneous duties. At least one laborer is required for each inspector and of course more will be required if many leaks are found. The following is the working organization which has saved over 45,000,000 gallons daily underground leakage in the past 13 years. This division is coordinate with the engineering, revenue and other major divisions of the Water Department of Washington, D. C. One engineer in charge, with a total of thirty-one employees. An assistant in charge of the field work, and under him four field parties for making house inspections and repairs to cut-off boxes, three of which contain a field operator, 2 inspectors and 3 laborers each, and the fourth an assistant field operator, one inspector and 3 laborers; also a draftsman. "Computations and office records" are in charge of an inspector, with the card records and files attended to by a skilled laborer, and the blue-printing and clerical work by another. "Extension of plant" is attended to by a machinist and a skilled laborer.

Waste prevention surveys have been made in numerous cities along the lines described and the results have been most gratifying. In one city over 2,000,000 gallons daily was the result of only one year's work by a single field party. Reference to official records of Washington, D. C. Baltimore, Md., Utica, New York City, and West Point, N. Y., Newark, Perth Amboy and Kearney, N. J., and many other places, reveals data proving the value of this work beyond all question.

BIDDING ON PUBLIC WORK

When Officials Can and Can Not Exercise Discretion—Must Observe Provisions Under Which Bids Were Invited—Rejecting All Bids.

By J. J. SIMPSON.

Where contracts are required to be let to "the lowest bidder," without qualification, the duty of awarding must be performed without the exercise of any judgment or discretion and the contract must be awarded to the bidder who is actually lowest. In such a case the duty of the board is ministerial and not judicial. It is a mere matter of computation. The law says the board may contract with the lowest bidder; not with the bidder whose bid, in their judgment, is the most advantageous to the city, but with the person who will bid to do the work for the least money. The situation here is entirely unlike those cases where the authority conferred is to let the contract to the lowest bidder "giving adequate security," or to the "lowest responsible bidder." Here the sole test is price. *People v. Scannell*, 40 Misc. (N.Y.) 297, 82 N. Y. Supp. 362; *Appleby v. New York*, 15 How. Pr. 428; *Holden v. Alton*, 79 Ill. 318, 53 N. E. 556; *Mueller v. Eau Claire County*, 108 Wis. 304, 84 N. W. 430.

Where the contract can be let to "the lowest responsible bidder" or "the lowest and best bidder," or some other similar qualifying word or phrase is employed, the general rule is that the municipality has a discretion in determining which is the lowest and best bidder, and its decision will not be interfered with by the courts, provided it acts in good faith, in the public interest, without corruption, collusion or fraud, or from motives.

of personal prejudice. *State v. Herman*, 63 Ohio St. 440, 59 N. E. 104; *People v. Gleason*, 121 N. Y. 631, 25 N. E. 4; *Interstate Vitrified Brick, etc. Co. v. Philadelphia*, 164 Pa. St. 477, So. Atl. 383; *Johnson v. Chicago Sanitary Dist.* 163 Ill. 285, 45 N. E. 213; *Kendinger v. Saginaw*, 132 Mich. 395, 93 N. W. 914; *Denver v. Dumars*, 33 Colo. 94, 80 Pac. 114.

But the authorities must in all cases exercise a real discretion based upon facts, and are not entitled to act arbitrarily. *People v. Buffalo*, 84 N. Y. Supp. 434; *Fourney v. Franklin*, La. 151, 52 So. 249; *Clapton v. Taylor*, 49 Mo. App. 117; *Baltimore v. Keyser*, 72 Md. 106, 19 Atl. 706. Even in good faith they may not arbitrarily prefer one bid over another, or negotiate privately with an individual bidder. *Chippewa Bridge Co. v. Durand*, 122 Wis. 85, 99 N. W. 603; and an arbitrary award may be prevented from being made if action is brought in time. *Molloy v. New Rochelle*, 123 N. Y. App. Div. 642, 108 N. Y. Supp. 120.

Frequently the right to reject any or all bids is reserved by statute or by the advertisement. In such a case the municipality has the power to reject any and all bids, and may consider the financial ability, business judgment and capacity, the skill, responsibility and reputation of the various bidders, and the quality of materials submitted. Inquiry, investigation, comparison, deliberation, and decision are necessarily involved. *United States Wood Preserving Co. v. Lundmaker*, 186 Fed. 678, and cases therein cited. In the exercise of a sound discretion the contract may be awarded to another than the lowest bidder. *Kelly v. Chicago*, 63 Ill. 279; *Peckham v. Watsonville*, 138 Cal. 242, 71 Pac. 169; *Kelly v. Baltimore*, 53 Md. 134; *Brown v. Houston (Tex.)* 48 S. W. 760. But there is no binding obligation to award it to any bidder, and all bids may be rejected and the improvement abandoned, if this is done in good faith. *Grant v. Detroit*, 91 Mich. 274, 51 N. W. 997. Or the authorities may reject all bids and readvertise. *Palmer v. Haverhill*, 98 Mass. 487; *State v. New Orleans*, 48 La. Ann. 643, 19 So. 690; *Keogh v. Wilmington*, 4 Del. Ch. 491. It has even been held that any bid may be rejected on a technicality. *Talbot Paving Co. v. Detroit*, 109 Mich. 657, 67 N. W. 979. Or all bids may be rejected, even if done arbitrarily and unwisely. *State v. Cincinnati*, 3 Ohio C. C. 542.

It is a well settled general rule that public authorities cannot make or permit any material changes in any of the terms of the proposed contract after the bids are in.

All persons desiring to bid upon the work willing to comply with the terms prescribed, should have equal opportunities to do so. If the work is not awarded upon the first competition for any particular reason, it should be submitted to a second, with full opportunity, as before, for all desiring to participate to do so. *Chippewa Bridge Co. v. Durand*, 122 Wis. 85. See also *Touchheim v. Philadelphia*, 218 Pa. 100.

The award of a contract containing provisions beneficial to the contractor, not contemplated by the forms of bid supplied to bidders, and which were substantially similar to the conditions incorporated in the bid of the contractor to whom the contract was awarded, was held invalid, although such conditions were stricken out before the acceptance of the bid. Otherwise the successful bidder would have had the advantage of two bids. *Wickwire v. City of Elkhart*, 144 Ind. 335, 43 N. E. 218. In this case the court said: "To require the bids upon one basis and award the contract upon another would, in practical effect, be an abandonment of all bids." To the same effect are *People v. Board of Improvement*, 43 N. Y. 229; *Shaw v. Trenton*, 19 N. J. L. 339. In *Inge v. Board of Public Works of Mobile*, 135 Ala. 200, 33 So. 678, the Alabama Supreme Court said that any material departure in the contract awarded from the terms and conditions upon which the bidding is had, renders the contract, in a sense, a private one. To permit such in the awarding of public contracts by public officers would be to open wide the door for favoritism and defeat the thing which the law intended to safeguard in requiring the contracts to be let upon bids made on advertised specifications. It is unimportant whether the additional stipulation contained in the contract awarded to one who is not the lowest responsible bidder be in itself an advantage to the city or not, if it constitutes a material change and therefore a departure from the basis of the bidding, and becomes an element or consideration in the determination of who is the lowest and best bidder, it will invalidate the contract entered into.

Where, in response to an advertisement for proposals to do certain work, upon certain conditions, a bid has been made and accepted, but the formal contract, contemplated by both parties, has not yet been drawn, the rights of the parties are so far fixed that the essential conditions of the proposal cannot be varied by either. So a condition which a board has statutory authority to make cannot be imposed upon a contractor whose bid has been accepted, unless it was contained in the advertisement. *Campbell v. City of Philadelphia*, 15 Phil. 141.

Private negotiations between municipal authorities and a successful bidder, through which the terms and conditions of the competitive bids are so modified and changed that the successful bidder becomes in fact the lowest bidder, are not within the spirit of the Pennsylvania statute requiring contracts to be awarded to the lowest responsible bidder. *Touchheim v. Philadelphia*, 218 Pa. 100.

Proposals for a water supply were advertised for and received by the authorities, and one of the competitors was permitted by the engineer, to whom the proposals were referred for calculation and comparison, to alter his bid so as to make it appear lower than that of the others. After acceptance of this bid, a contract was made at higher prices, with a large number of prices stipulated for therein not in the competition at all, and with a material clause inserted to the benefit of the contractor, in no manner contemplated by or offered to the other bidders. It was held, *Dickinson v. Poughkeepsie*, 75 N. Y. 65, that the contract was unauthorized and void.

In *Case v. Trenton*, 76 N. J. L. 700, it was said; The municipal authorities should not be permitted to waive any substantial variance between the conditions under which bids are invited and the proposals submitted. If one bidder is relieved from conforming to the conditions which impose some duty upon him, or lay the ground for holding him to a strict performance of his contract, that bidder is not contracting in fair competition with those bidders who propose to be bound by all the conditions. This is the policy which prevents the modification of specifications after bids have been presented, and the awarding of the contract to one of the bidders based upon such revised specifications.

Where a bid, filed within the time fixed by the advertisement for receiving bids, is substantially changed and modified after such time, it is to be regarded as a new bid, received after other competitors, by the terms of the notice, had a right to presume that the contest was closed, and it could not be legally accepted. *Fairbanks v. City of North Bend*, 68 Neb. 560.

After accepting a bid, alterations cannot be made in the contract which materially change it from that submitted to competitive bidding. *Moran v. Thompson*, 20 Wash. 525. *Addis v. Pittsburgh*, 85 Pa. 379. *Townsend v. Holt County*, 40 Neb. 852. It has been held that this is so notwithstanding the fact that but one bid was presented for the work. *Le Tourneau v. Hugo*, 90 Minn. 420.

Under the rule above stated public authorities cannot extend the time for receiving bids. *State v. York County*, 13 Neb. 57. But it has been held that they might consider a bid accidentally delayed beyond the time limit, delivered before any others were opened and where there was no fraud. *Kerr v. Central Board*, 25 Pittsb. L. J. N. S. 54.

The time within which the contract is to be completed cannot be extended. *Kaisch v. San Francisco*, 80 Cal. 1, 22 Pac. 22; *Chicago v. Mohr*, 216 Ill. 320, 74 N. E. 1056; *McQuiddy v. Brannock*, 70 Mo. App. 535; nor can the time for payment of the contract price. *Diamond v. Mankato*, 89 Minn. 48, 93 N. W. 911.

If the first award should fail, or if the contractor thereunder abandon the work before completion, all bids may be rejected, and the work readvertised. *People v. Fay*, 3 Lans. (N. Y.) 398; *Goss v. State Capitol Commission*, 11 Wash. 474; *Murphy v. Philadelphia*, 25 Phil. Leg. Int. 333. Or, if no statute is thereby violated, and the rights of no third party have intervened, and in the absence of fraud, the contract may be awarded to the next lowest bidder. *Kinsella v. Auburn*, 54 Hun, (N. Y.) 634; *Corry v. Corry Chain Co.*, 18 Pa. Super. Ct. 271; *Turner v. Fremont*, 159 Fed. 221 affirmed 170 Fed. 259; *Gibson v. Owens*, 115 Mo. 258; *In re Leeds*, 53 N. Y. 400; *Leitz v. New Orleans*, 136 La. 483; 67 So. 339; *Sanitary Dist. v. McMahon, etc. Co.*, 110 Ill. App. 510.

Though the Michigan court has held, *Twiss v. Port Huron*,

63 Mich. 528, 30 N. W. 177, where the statute required the award to go to the lowest bidder, and the lowest bid was allowed to be withdrawn because of an alleged mistake, and the contract was then awarded to the next lowest bidder without readvertising, that this was without the rightful discretion of the authorities. And the California courts also hold that in such a case it is necessary to readvertise before awarding the contract to another. *Meuser v. Ridson*, 36 Cal. 239, *Dougherty v. Foley*, 32 Cal. 402.

COURSE IN HIGHWAY ENGINEERING AND TRANSPORT.

The University of Michigan is offering a short-period graduate course in Highway Engineering and Highway Transport, which is intended to meet the needs of practicing engineers, contractors, and engineer-salesmen. A schedule extending from December 1st to March 19th has just been approved by the Board of Regents of the University.

Nine courses are included; these, with the fees for each, being as follows:

By Prof. Arthur H. Blanchard: Highway Transport, Feb. 2 to 6; \$5. Bituminous Surfaces and Bituminous Pavements, Dec. 1 to 19; \$15. Cement Concrete Pavements, March, 1 to 9; \$5. Brick Pavements, March 11 to 19, \$5. Highway Engineering Seminar, Dec. 1 to March 19; \$15.

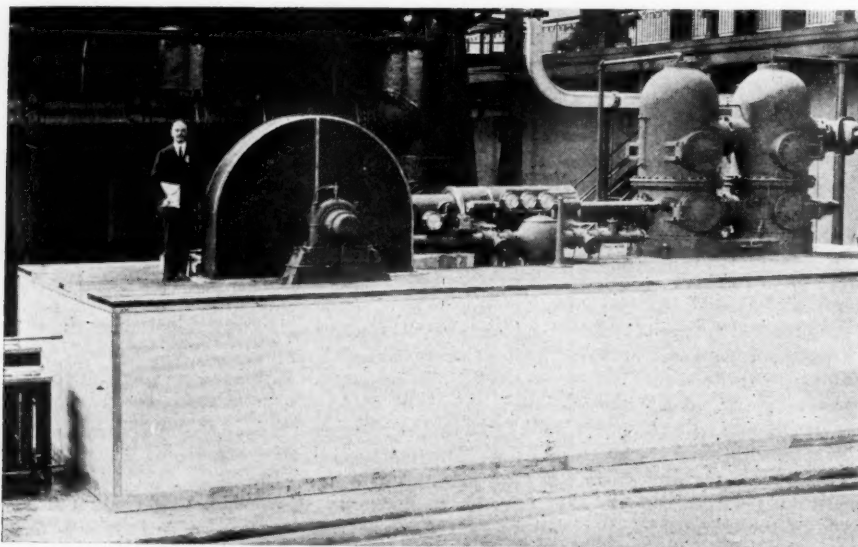
By Prof. John H. Bateman: Highway Laboratory Research, Jan. 5 to 23; \$10 to \$15 (depending upon student's previous training in highway laboratory methods). Earth, Gravel and Broken Stone Roads, March 1 to 12; \$10.

By Prof. Lewis M. Gram: Highway Bridges, Feb. 9 to 20; \$10. By Prof. Henry E. Riggs: Specifications and Contracts, Feb. 9 to 20; \$10.

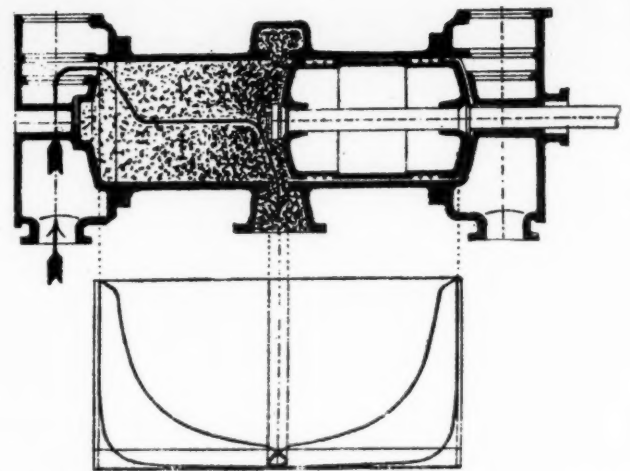
Further information may be obtained from Prof. Blanchard, who states that "the University of Michigan is at present the only institution offering work of this character."

TESTS OF A UNAFLOW PUMPING ENGINE.

A type of steam engine known as the Unaflo has come into more or less prominence during the past year or two, and while the principle of it is not particularly new, successful efforts to develop it as a practical and efficient commercial machine are quite recent. A pump of this kind has been installed at the Porter Avenue pumping station of the Buffalo water works which has a capacity of about three million gallons in 24 hours. Tests have been made on this pump by the builders, and these tests are being continued, and it is possible may lead to slight modifications in design or operation of the pump. The principle of the pump and the results of the tests so far made formed the subject of a paper before the New England Water Works Association by A. Decrow of the Worthington Pump and Machinery Corporation, New York. The information therein given is abstracted below.



INSTALLATION IN THE PORTER AVE. PUMPING STATION OF THE BUFFALO WATERWORKS.



TYPICAL UNAFLOW STEAM CYLINDER AND INDICATOR CARD.

The pump derives its name from the fact that the steam entering the cylinder travels through it continuously in one direction. The heat energy of the steam is utilized in the cylinder during the period of its admission, expansion and flow, the expanded steam being exhausted through ports or openings uncovered by the travel of the cylinder piston when most remote from the point of admission. A typical cylinder is shown in the accompanying diagram.

In this, the piston is shown at one end of the stroke and the exhaust ports are uncovered. The arrow indicates the path of the steam through the cylinder. There is practically no change of temperature of the steam until the point of cut-off is reached. After this, expansion takes place with a constant drop in temperature, and at this time condensation begins due to the changing of heat into work. The cylinder head is jacketed with high steam, consequently no condensation takes place on the walls of the head, but condensation takes place on the wall of the piston, which is comparatively cool, so that at the end of the stroke the moisture of condensation is mostly at the exhaust end of the cylinder; and as the steam expanding from the cylinder head rushes out through the exhaust port, it takes the moisture with it. At this time there is a sudden drop in temperature in the cylinder due to the sudden drop of pressure, but as the inlet end of the cylinder is dry and the flow of heat from a dry surface is slow, there is no perceptible drop of temperature on these dry walls. On the return stroke the exhaust port is covered by the piston, trapping in the cylinder comparatively dry steam that has been partially superheated. As the walls of the cylinder have retained their heat, the heat of compression is not absorbed by either moisture or cold walls

as in the case of the counter-flow engine, and the steam remaining in the clearance is heated by compression to a temperature above that of the initial steam. When the valve is opened to start the next stroke, the live steam rushes into the clearance space, and as the entrapped steam here is hotter than the entering steam, there is no initial condensation. Practically all of the moisture is removed at each stroke and therefore the heat losses caused by the pressure of water in counter-flow engines are avoided.

In addition, leakage losses at the exhaust valves, found in counter-flow engines, are eliminated. The absence of initial condensation permits a high economic ratio of expansion in one cylinder. There is therefore apparently no particular gain in economy in compounding this type of engine.

The engine in the Porter avenue station is of the horizontal type with one steam cylinder and one double-

acting plunger pump. It was designed for a water pressure of 100 pounds, suction lift of 15 feet plus the friction in 60 feet of suction pipe, a steam pressure of 235 pounds and 100 degrees F. superheat. The engine is entirely encased so that no moving parts whatever are visible.

One of the problems in connection with adapting this engine to pumping was to develop a pump valve that would operate satisfactorily under all the varying conditions of speed and pressure to which pumping engines may be subjected. A valve has been designed which it is thought meets these requirements. In order to test it, it was placed in a power pump, driven by a variable speed motor and having a single-acting plunger; the valves being surrounded by glass cylinders so that their operation could be observed. This pump was run at speeds varying from 50 to 290 revolutions per minute. The maximum lift of the valve was three-tenths of an inch. The average velocity through the valves at the various speeds varied from 1.54 feet per second to 7.42 feet. The slip in no case exceeded four-tenths of one per cent, while at some speeds the slip was calculated to be negative—that is, the plunger displacement was less than the water pumped. The valve was noiseless in operation until, at 290 r. p. m., it tapped the valve guards.

It has not yet been possible to obtain all of the working conditions for which the Porter avenue pump was designed. For instance, instead of 100 degrees superheat, it is found that less than one-tenth of this is actually available. An independent superheater which was being installed at the time this paper was written would permit making tests with degrees of superheat varying from 10 to 200 degrees.

A test for steam consumption has been completed with approximately 200 pounds steam pressure, 95 pounds water pressure, 10 degrees superheat, 27.2 inches vacuum and 203 revolutions per minute, and the resulting steam consumption per indicated horse-power-hour was approximately 12.4 pounds, as compared with 11.9 pounds which the perfect unafflow engine with 27 inches vacuum is supposed to develop under these conditions. The resultant duty was something under 140 million foot-pounds.

A slip test with calibrated nozzles was made at speeds ranging from 100 to 202 r. p. m. and the percentage of slip was found to decrease at a uniform rate as the speed of the pump increased.

Both these tests were made hurriedly for the purpose of obtaining data to present with this paper, but many more tests are contemplated in order to obtain a more complete and accurate knowledge of the possibilities of the pump.

UNLIMITED FUNDS FOR ROAD CONSTRUCTION

The total amount available for hard-surface highways in 1920 is \$633,000,000, according to the computation of the Bureau of Public Roads of the U. S. Department of Agriculture. The amount spent this year will, it is estimated, total \$138,000,000, which is the record so far; but is only about one-fifth the amount available for next year.

It is improbable, of course, that all of this can be spent, but its availability means that the expenditure will be limited only by the quantity of materials and labor available, the facilities for railway transportation, the inclinations of the several boards or other governmental agents having charge of the work, or other limitations not financial. For all practical purposes, therefore, the amount of money available is "unlimited."

Of this total, \$165,000,000 is carried forward from unfinished 1919 contracts; \$273,000,000 will be furnished by state and county taxes and Federal aid; \$50,000,000 by one-fifth state and county bond issues not before available; \$45,000,000 by one-third unexpended balance of state and county bond issues previously available; and \$100,000,000 available from new bond issues to be voted on before next summer.

The limit set by the freight facilities can be extended if only road building interests will prepare now to utilize all spare railway cars between now and spring for hauling road materials, especially the gondola or open-top cars, many of which normally lie idle in the late winter. Consequently Thomas H. MacDonald, Chief of the Bureau of Public Roads, recommends that contracts be let during December and January for as great a mileage of roads as possible.

It has been customary to wait until contractors' organizations were ready to begin work before starting the shipment of material. Under these conditions many thousands of open-top cars lie idle during the latter part of February, all of March and the earlier part of April. During the past spring the number of open-top cars that were idle totaled more than 250,000. This, of course, was partly unavoidable owing to the date at which work got under way, following the signing of the armistice. By awarding contracts as early as possible, contractors will be able to ascertain their material requirements at different points, and so will be in position to place orders dependent on rail transportation a considerable time in advance.

While the placing of material in storage, which may result from such a course, involves some expense, it will be small compared to the loss that will result if contractors are not in a position to go ahead with the work because of lack of materials. In view of the experience of 1919 and the greatly increased program for next year, it seems probable, according to the Bureau of Public Roads, that contracts which are not awarded during the winter months will have little opportunity for being supplied with materials which require rail transportation.

COAL AND PUBLIC UTILITIES.

The strike of the coal miners affects all phases of domestic and commercial life of the country, not the least important being the various public utilities that rely upon coal for power. Such utilities serve individual citizens, and communities as such, with gas; electric light; electric power used for pumping water, operating street railways and for various commercial purposes; heating from central plants, and other public and semi-public services.

The cutting off of electric power alone would be a serious matter, and the amount of coal used by public utility power plants in this country is enormous. The U. S. Geological Survey reports that during February, March and April of this year 8,445,184 tons of coal were used by such plants, or an average of 665,000 tons a week. As far as weather affects the consumption, this period would approximately be similar to November, December, and January; but it is probable that consumption has increased since then, with more complete recovery from war conditions.

During the same period 2,006,559 barrels of petroleum derivatives were used as fuel, and 5,111 million cubic feet of natural gas; the last increasing in quantity month by month. However, in only fifteen states was it used at all, and in four of these the amount used was insignificant.

More effective is the use of hydraulic power. About 70 per cent. as much electric power was created by this means as by coal. Moreover, the use was more wide-spread, forty-four states reporting hydro-electric power used by public utility plants, the amount being quite considerable in thirty-three.

There is not only mining, but also rail transportation to consider. The amount named above is equivalent to about 2,100 45-ton carloads a day. Strikes, blizzards or other causes of decrease in transportation facilities seriously interfere with coal deliveries, as past experiences show. Each year it is demonstrated more convincingly that it is the part of wisdom to use, for public utilities, such sources of power other than coal that nature has provided for the locality in question.

HOUSTON IN THE FOOD BUSINESS.

Houston, Texas, which has a municipally owned retail market house, has taken over three stalls in the building and is handling fruits and vegetables in competition with its tenants. In order to be fair to other retailers, it charges, itself with all overhead expenses paid by other dealers, including rent, and also pays wages higher than those paid in other stalls. Reports on ten weeks' operation of the city-managed stalls show that it is possible to buy and sell produce in competition with local merchants at both a direct and indirect saving to consumers. The experiment is to be enlarged to include food products other than fruits and vegetables and is said to be already serving as a stabilizing influence in that city market. Competing merchants have become interested in the methods of doing business of the city-operated stalls and appear anxious to try out practices that would enable them to lower their prices.

NEWS OF THE SOCIETIES

Nov. 12-14.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, New Orleans, La. Secretary, Charles C. Brown, Springfield, Ill.

Feb. 9-13, 1920.—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention, Louisville, Ky. Secretary, E. L. Powers, 150 Nassau street, New York.

National Highway Traffic Association

A public meeting of the North Atlantic Division of the National Highway Traffic Association will be held at the Automobile Club of America, 247 West 54th Street, New York City, at 8:00 p. m., on Friday, November, 7th.

The following program will be presented:

Progress Report of Committee on "Sign Posting for Detours and Thru Routes in Municipalities," chairman, Elmer Thompson secretary, Automobile Club of America.

"Present Status of Impact Tests on Roadway Surfaces," A. T. Goldbeck, testing engineer, United States Bureau of Public Roads.

"Motor Vehicle Traffic which Requires the Use of Cement-Concrete Foundations," W. G. Thompson, state highway engineer of New Jersey.

"Relation of the Motor Truck to the Railroad," C. W. Reid, manager, Transportation Bureau, Federal Highway Council.

Dinner will be served in the Club at 6:30 p. m. The public is cordially invited to attend both the dinner and the meeting. Dinner reservations should be addressed to secretary Elmer Thompson, 247 West 54th St., New York City.

New England Water Works Association

The November meeting of the New England Water Works association will be held at the Hotel Brunswick, Copley Square, Boston, November 12.

Following an executive committee meeting in the morning and a luncheon, two papers will be read in the afternoon:

"The Prevention and Cure of the Red Water Plague," by Prof. William H. Walker, Massachusetts Institute of Technology, Boston.

"Modern Pumps for Small Water Works," by Creed W. Fulton, New England manager, Gould Mfg. Co.

The Nominating Committee appointed by president Killam to present nominations for officers for the association for the year 1919 have reported as follows:

President, Henry V. Macksey, Supt. of Public Works, Woburn, Mass.

Vice-Presidents: Charles W. Sherman, Consulting Engineer, Boston, Mass.; Frank A. Barbour, Consulting Hydraulic and Sanitary Engineer, Boston, Mass.; Percy R. Sanders, Supt.

Water Works, Concord, N. H.; Beekman C. Little, Supt. Water Works, Rochester, N. Y.; James H. Mendell, Supt. Water Works, Manchester, N. H.; William W. Brush, Deputy Chief Engineer, Dept. of Water Supply, Gas and Electricity, New York, N. Y.

Additional Members of Executive Committee: A. R. Hathaway, Water Registrar, Springfield, Mass.; Patrick Gear, Supt. Water Works, Holyoke, Mass.; David A. Heffernan, Supt. Milton Water Works, Milton, Mass.

Secretary, Frank J. Gifford, Supt. Dedham Water Company, Dedham, Mass.; Editor, Henry A. Symonds, Consulting Engineer, Boston, Mass.; Treasurer, Lewis M. Bancroft, Supt. Water Works, Reading, Mass.; Advertising Agent, Henry A. Symonds, Consulting Engineer, Boston, Mass.

Finance Committee: George H. Finneran, Supt. Water Service, Boston, Mass.; George A. Carpenter, City Engineer, Pawtucket, R. I.; Frank A. Marston, Designing Engr., Metcalf & Eddy, Boston, Mass.

American Association of Engineers

The Board of Directors of the American Association of Engineers in its quarterly meeting on October 11 adopted a resolution announcing a militant attitude of the Association toward licensing and registration of engineers. Every effort will be made to have a license bill enacted in every state in which there is none at present. Chapters were advised to appoint license committees, each of which is to cooperate with the National License Committee in drafting the national bill for adoption in all states. Action will be taken also to insure enforcement of existing license laws. The resolution states that "it shall be the duty of chapter committees to see that the law is enforced, both in letter and in spirit, and that such amendments are made to the law from time to time as experience renders advisable in order that the profession may be kept in a high plane."

That the employment service of the American Association of Engineers is beginning to occupy a strong position in the engineering profession is made evident by the fact that within the last month inquiries have been received for two eight thousand dollar men and one twelve thousand dollar man. There is a great surplus of positions vacant for draftsmen and junior engineers, paying \$200 a month and less. The board of directors of the Association at its meeting on October 11 adopted a resolution favoring the development of the Service Department until it is the most efficient employment service for engineers in the United States.

As an outgrowth of the resolution adopted at the last convention of the American Association of Engineers

that a committee should be appointed to promote the non-technical interests of engineers in public service, the board of directors of the American Association of Engineers recently authorized the organization of a Federal Department of A. A. E.

This department will be composed of all engineers who are employed by the Federal Government and will have its headquarters in Washington. The engineers in the different departments and bureaus of the Government will organize into sections which will be a part of the Federal Department. Sections will be organized into local branches. There will be, for instance, the San Francisco Branch of the Navy Section of the Federal Department of the American Association of Engineers. Branches and sections will be subordinate to chapters having jurisdiction over the territories in which they are located.

The Federal Department will be financed in the same manner as the railroad campaign was financed at the beginning; the engineers to be benefited by the department will be asked to subscribe from one to five dollars each to an organization fund, which will provide for the initial outlay and the expansion of the district office in Washington.

By a referendum vote of the membership of the American Association of Engineers, completed on October 15th, the entrance fee of the Association for 1920 was changed from \$6.00 to \$10.00. The change will be made on December 31.

The Board of Directors of the American Association of Engineers has approved petitions of clubs of A. A. E., at Newport, Rhode Island, New Castle, Pennsylvania; and chapters at Globe-Miami, Arizona, and Terre Haute, Ind. Chapter petitions which have not yet been acted upon have been received from Tulsa, Oklahoma, and Butte, Montana. Chapters were recently established at Columbus, Ohio; Ohio State University; Oil City, Pennsylvania; Buffalo, New York; and Bellaire, Ohio.

The American Association of Engineers announces the appointment of H. G. Shirley, of the Highways Industries Association in Washington as corresponding highway member of the Committee on Salaries of Engineers in Public Service, of which A. N. Johnson, consulting highway engineer of the Portland Cement Association, is Chairman.

The corresponding highway members, in addition to Mr. Shirley, are: Thos. H. McDonald, chief of U. S. Bureau of Public Roads; W. L. Passet, Bureau of Municipal Research, New York; Col. W. D. Uhler, chief engineer, Pennsylvania State Highway Department; B. Fletcher, State Highway Engineer of California; A. W. Dean, chief engineer, Massachusetts Highway Commission and Clifford Older, chief engineer Illinois State Highway Department.

INDUSTRIAL NEWS

Well-Known Men Join International Exposition of Municipal Equipment.

Mrs. Jeanne Carpenter, director of the International Exposition of Municipal Equipment in the Grand Central Palace, announces two additions to the permanent staff.

E. J. Dewine who has for the past two years been in the construction division of the U. S. Army, takes charge of the department of streets, asphalt and road machinery. Mr. Dewine has had a wide and varied experience in this field, having begun his experience in 1895 with the Warren-Scharf Asphalt Paving Co., which finally developed into Warren Bros. In 1900 he joined the Southern Paving Construction Co., and for eight years was associated with it, and the jointly owned Southern Clay Mfg. Co. In the succeeding years he was identified with the Southern Contracting Co., the road department of the Barrett Co., and the U. S. Asphalt Refining Co. Mr. Dewine combines with a thorough knowledge of his profession a very wide acquaintance.

J. H. Brewster is a sanitary engineer, and since his discharge from the army has been identified with the engineering department of the New York State of Health, where he had direct supervision of the investigation of plants producing milk or milk products, including investigation and reports on the plants, design, and construction, and general equipment installed. After completing his course in chemical and sanitary engineering at the Rensselaer Polytechnical Institute, Mr. Brewster was connected with the American Water Works and Electric Co., of New York City for nearly four years, as sanitary engineer, having charge of the operation of water purification plants. Later he joined the Indiana State Board of Health for four years. There his work included the approval of plants for water and sewage systems, the construction and operation of purification plants, together with the sterilization of water and sewage, and the chemical and bacteriological work connected therewith. He made surveys of lakes, rivers, and watersheds, and traced the outbreaks of epidemics, as well as other work coming under the control of his department. Mr. Brewster will have charge of the health, water, sewage disposal and milk sections of the Exposition.

The Engineering Advertisers' Association of Chicago has just been organized, the membership being limited to advertising and sales executives of concerns engaged in the manufacture of engineering products.

The association was founded by a group of men actively engaged in the production end of advertising work, including H. L. Delander of the Crane Co., P. A. Powers of the Benjamin

Electric Manufacturing Co., Glenn H. Eddy of the Green Engineering Co., J. J. Arnfield of Fairbanks, Morse & Co., and Albert H. Hopkins of the C. F. Pease Co. It was the opinion of these men that the advertising activities of manufacturers of engineering products have assumed such magnitude as to necessitate an independent organization devoted exclusively to this special field.

P. A. Powers, one of the directors, outlined the purposes of the Association as follows: "We seek to improve present methods of advertising and selling engineering products by trying to bring the truth to bear upon our problems; by each one laying down his own methods and submitting to friendly criticism; by co-operating in various active efforts and by the interchange of ideas and experiences."

The committee in charge of the winter program has arranged for a comprehensive series of lectures which will be delivered at the monthly meetings by men who are recognized authorities in the subjects assigned. Such questions as better typography in engineering advertising, the use of art in advertising technical products, markets and their analysis, the kind of data which should be accumulated by advertising managers, and other very practical topics will be discussed by experts. The membership now includes a great many of the members of the advertising profession who are prominent in their work. The control of the association is vested entirely in advertising and sales directors as it is the intention to limit the membership to men actively engaged in advertising and selling engineering products.

Standardization of Electrical Products.

At the regular fall section meeting of the Associated Manufacturers of Electrical Supplies held October 14-15 at headquarters in New York City, in addition to the general work of the sections in standardization of various materials and devices, the adoption of the standards approved and recommended by the different sections was discussed and also the plan to have these standards issued as the standards of the association. Other bodies have at various times suggested joint meetings for the consideration of subjects of mutual interest, including the American Institute of Electrical Engineers, Standards Committee, N. E. L. A. Wiring Committees, the Underwriters' Laboratories, Western Association of Electrical Inspectors, Compressed Air Society and others. This led to the suggestion that a general committee be formed from sections, with the approval of the board of governors and counsel, the function of which would be to represent the association in matters of standardization and to evolve procedure by which section standards may become standards of the association and generally to centralize the association's standards work to the end that

all interested parties may be advised of proposed action and the necessary provision for same made. Subjects which are expected to come under consideration are:

1. The determination of the relation of the Bureau of Standards at Washington to the initiation of codes, etc.

2. The proposed broadening of the American Engineering Standards Committee.

3. The proposed legislation conferring on the Bureau of Standards the power to establish standards of quality for manufactured product.

4. The desire of other national associations, such, for instance, as the American Institute of Electrical Engineers, to confer and co-operate with the association in the adoption of standards in which there may be mutual interest.

5. The determination of what shall be a standard of the association and the evolution of an orderly process by which, when desirable, the standards adopted by a section may become the standards of the association.

6. The desirability of the collection and preservation of standards already adopted by the various sections in form which shall make them readily available.

All such work would naturally come under the advice of counsel and every possible means taken to avoid complications or anything which might be considered illegal.

The Lakewood Engineering Co., Cleveland, O., announces that Capt. P. H. Brigham, 130th Engineers, U. S. A., recently returned from France after nineteen months foreign service, has received his discharge and has entered the service of the Paving Department of the company as field engineer for New York, New Jersey and New England. Before Capt. Brigham entered the army in May, 1917, he was employed as assistant engineer with the New York State Highway Department with headquarters at Binghamton, N. Y.

The Ingersoll-Rand Company, Broadway, New York City, has issued a number of new pieces of literature. Copies may be had free on request to either New York or any of the branch offices.

Form No. 8707 is a forty page, 6x9 inch bulletin on "Little David" pneumatic drills, grinders and saws. It illustrates the various sizes and models of the different machines and contains detailed description concerning the particular tool to use for a given purpose. The descriptive matter is supplemented with a number of tables giving air consumption of the various tools, etc.

Form No. 945, entitled "Tis a Good Investment," illustrates ER and FR compressors in small machine shops, power houses, garages, etc.

Form No. 954 is an 8½x11 inch sheet descriptive of the "Air Lift Method of Pumping."

ADVANCE CONTRACT NEWS

ADVANCE INFORMATION BIDS ASKED FOR

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information concerning it as early as possible; also correction of any errors discovered.

CONTRACTS AWARDED ITEMIZED PRICES

BIDS ASKED FOR

STREETS AND ROADS.

- Ark., Tombstone.** 2 pm, Nov. 17.
89,377 sq. yd. pavement on 2 sections road in Cochise co.—T. Maddock, state engr.
- Ark., Little Rock.** 11 am, Nov. 14.
72.5 mi. asphaltic macadam (penetration method) pavement in Sebastian co., involving 37.5 acres clearing and grubbing; 12,655 rods fence moving; 301,295 cu. yd. embankment; 10,615 cu. yd. solid rock excav.; 4,040 cu. yd. loose rock excav.; 560 lin. ft. 18-in., 2,465 ft. 24-in., 663 lin. ft. 30-in., 1,433 ft. 36-in. and 6 ft. 48-in. pipe of vitr. clay, metal or rein. concr. (hauling and placing only); 1,510 cu. yd. concr. in culverts; 368 cu. yd. concr. in pipe head walls; 1,853 cu. yd. concr. in bridge abutments; 39,440 lbs. reinforcing metal; 381 lin. ft. I-beam bridges; 960 lin. ft. truss bridges; 680,724 sq. yd. pavements, hauling stone, etc.—Carter & Knoch, civ. engr., A. O. U. W. bldg.
- Cal., Sacramento.** Nov. 17.
20 mi. grading on San Diego-Imperial road between Pine Valley and Tecate divide—State hwy. comm.
- Fla., De Soto.** noon, Nov. 25.
10,000 sq. yd. vitr. brick paving and laying 1,500 ft. 6-in. sewer house connections.
- Ga., LaGrange.** Nov. 18.
13 mi. road between LaGrange and co. line with concr. bridges and culverts, involving 117,000 lbs. steel reinforcing, 957.4 class A concr., 154.8 class B concr., 105 cu. yd. stone rip rap, 248 cu. yd. wet excav., etc. for 16 concr. bridges; clearing, grading, pipe, top soil, etc. on 3 projects, involving 19 acres clearing and grubbing, 1,650 lin. ft. vitr. clay pipe, 127 cu. yd. concr. headwalls, 111,668 cu. yd. earth excav. and borrow, 1,200 cc. yd. rock excav., 45,000 topsoil surfacing, 10 mi. grassing slopes—Garrett & Slack, Bell bldg., Montgomery, Ala.
- Ga., Americus.** 10 am, Nov. 21.
3 mi. fed. aid. proj. no. 102, 1-course concr. or bituminous macadam, or rock asphalt, or Willite asphalt, involving 31,880 sq. yd. pavement, 11,058 cu. yd. common excav., concr. in culverts and headwalls, 200.5 lin. ft. D. S. V. pipe, 1,017.8 sta. yds. overhaul, 31,880 lin. ft. 2x8-in. wood curb, etc.—Thomas & Hawkins, engr., 302 Forsyth bldg., Atlanta.
- Ga., Savannah.** noon, Nov. 20.
Grading, draining and paving road from Savannah to line between Chatham and Effingham cos., including culverts, pipes, headwalls and drains, and scarifying, rolling and repairing, involving 17,457 lin. ft. road 18 ft. wide, 34,194 sq. yd. paving under fed. aid. proj. no. 103, and 51,103 lin. ft. 15-ft. road, 90,840 sq. yd. pavement; also grading, draining and paving 65,637 lin. ft. 16-ft. road from Savannah to line between Chatham and Bryan cos., involving 116,688 sq. yd. pavement and 3 bridges—R. Butler, clk., co. comrs.
- Ind., Hammond.** 10 am, Nov. 19.
Grading and paving roadway—Bd. pub. wks.
- Ind., Albion.** 2 pm, Dec. 2.
Road in Washington twp., Noble co.—H. C. Erwin, co. aud.
- Ind., Anderson.** 10 am, Nov. 17.
9,340 ft. concr. road in Lafayette twp. and 2,165 ft. concr. road in Van Buren twp., Anderson co.—E. T. Flahavin, co. aud.
- Ind., Fort Wayne.** 10 am, Nov. 17.
16,012 ft. road in Wayne twp., Allen co.—A. C. McCoy, co. aud.
- Ind., Lebanon.** 11 am, Nov. 19.
Gravel road on co. line between Hendricks and Boone cos.—C. Goodwin, aud., Boone co.
- la. Oskaloosa.** 8 pm, Nov. 17.
Paving in various streets—H. C. Hawkins, engr., city hall.
- la., Leon.** 8 pm, Dec. 3.
10,000 sq. yd. paving with brick, rein. concr., sheet asphalt, asphalt concr., or bituminous concr., est. \$150,000—C. A. Shockley, 740 Reserve Bank bldg., Kansas City, Mo.
- Kan., Emporia.** 1.30 pm, Nov. 26.
Section of fed. aid. proj. no. 30 in Lyon co., 23.00 ft. 18--ft. road of 1 course concr., 2-course concr., monolithic brick, or bituminous filled brick on sand cushion with concr. base, with 5-ft. earth shoulders on each side, etc., involving 16,406 cu. yd. earth 47,400 sq. yd. paving, 639 cu. yd. concr. in culverts and bridges and 25,933 lbs. reinforcing steel—G. L. Miller, co. clk.
- La., New Orleans.** noon, Nov. 24.
11.3 mi. Melville-Palmetto hwy. in St. Landry parish; 19.8 mi. Alexandria-Oberlin hwy. in Rapides parish; and 8.05 mi. Coushatta-Shreveport hwy. in Red River parish; also following sections of New Orleans-Hammond hwy.; 14.27 mi. from Pontchatoula to Maine; 18 mi. from Manchac to Labranch; 15.93 mi. from Labranch to West End, Tangipahoa, St. John the Baptist, St. Charles and Jefferson parishes—Duncan Buie, state hwy. engr., 736 Maison Blanche annex.
- Me., Augusta.** 11 am, Nov. 19.
7.05 mi. state hwy. in town of Enfield, grading, draining and gravel-surfacing—P. D. Sargent, chf. engr., state hwy. comm.
- Md. Baltimore.** noon, Nov. 28.
State road in Faulkner—P. H. Zouck, chn., state road comm., 601 Garrett bldg.
- Mich., Lansing.** 1.30 pm, Nov. 17.
Improving 6.443 mi. road in Tobacco twp., Gladwin co., consisting of shaping road drainage structures and gravel surfacing to width of 16 ft.—F. F. Rogers, state hwy. comm.
- Mich., Lansing.** 1.30 pm, Nov. 18.
Improving 8.068 mi. road in Arenac twp., Arenac co., by shaping road and surfacing to width of 16 ft. with gravel—F. F. Rogers, state hwy. comm.
- Mich., Lansing.** 10 am, Dec. 2.
Improving 48.503 mi. road in Powell, Champion, Ishpeming, Marquette and Negaunee twps., and Negaunee city, Marquette co., by grading and drainage structures, involving 231 acres clearing; 34,385 sq. yd. grubbing; 474,327 cu. yd. earth, 81,610 cu. yd. loose rock, 5,132 cu. yd. solid rock and 21,778 cu. yd. ditch excav.; 89,202 lin. ft. guard rail; 1,667 cu. yd. retaining wall, (rubble); 63,231 lbs. steel reinforcement in culverts; 12,912 lin. ft. installing corrugated iron culverts, etc.—F. F. Rogers, state hwy. comm.
- Mich., Lansing.** 1.30 pm, Nov. 17.
Improving 7,120 mi. road in Sylvan twp., Washtenaw co., involving shaping road and drainage structures—F. F. Rogers, state hwy. comm.
- Mich., Freeman.** Nov. 30.
1 mi. 12--ft. class B state reward road and 1½ mi. 12--ft. road in Glare co.—J. W. Wilson, twp. clk.
- Minn., Crookston.** 2 pm, Nov. 24.
12 mi. fed. aid. proj. no. 80, involving 13 acres clearing and grubbing, 37,993 cu. yd. excav., 33,431 cu. yd. haul, 1,398 lin. ft. 12 to 30--in. portable culverts, 48 rein. concr. culverts, and 14,229 cu. yd. gravel surfacing; 10 mi. fed. aid. proj. no. 94, involving 82,774 cu. yd. excav., 86,516 cu. yd. haul,

326 lin. ft. 12 to 36-in. portable culverts, 12,000 cu. yd. gravel surfacing, etc.; 1½ mi. fed. aid. proj. no. 1913, involving 14,316 sq. yd. concr. paving and 14,320 ft. drain tile, all in Polk co.—H. J. Welte, co. aud.

Mo., New Madrid. 2 pm, Nov. 17.
Grading, clearing, ditching, rock surfacing and laying tile and metal pipe culverts on 12.05 mi. road in New Madrid co.—C. V. Hansen, hwy. engr.

Mont., Helena. 2 pm, Nov. 20.
Grading, draining and gravel surfacing 3.6 mi. fed. aid. proj. no. 15 in Rosebud co.; grading, draining and gravel surfacing, etc. 2.84 mi. fed. aid. proj. no. 40 in Gallatin co. and one 50-ft. steel span over East Gallatin river; grading, draining, gravel surfacing, etc. 26 mi. fed. aid. proj. no. 53 in Yellowstone co.—Chf. engr., state hwy. comm., Capitol bldg.

Nev. Carson city. noon, Nov. 18.
16.67 mi. state hwy. from Lovelock to Zola, Pershing co., involving 40,000 cu. yd. excav. 105,503 sq. yd. 5-in. gravel surface, 200 cu. yd. class A concr., 65 cu. yd. class B concr., 350 lin. ft. 12-in., 694 lin. ft. 18-in., 200 lin. ft. 24-in., and 130 lin. ft. 30 to 36-in. metal pipe, etc.; also 2.76 mi. state hwy. in Washoe co., involving 12,300 cu. yd. excav., 346 lin. ft. 15-in., 140 lin. ft. 18-in., 26 lin. ft. 24-in. and 28 lin. ft. 30-in. metal pipe, 35 monuments, etc.—C. C. Cottrell, state hwy. engr.

N. J. Atlantic City. 3 pm, Nov. 20.
Improving portions of streets, including dredging waterway and depositing dredging materials on streets, involving 94,000 cu. yd.; setting 20,200 lin. ft. wood curbing, graveling 40,700 sq. yd. driveways and 12,800 sq. yd. sidewalks and 14,750 sq. yd. grass plots; constructing 350 lin. ft. terra cotta pipe culvert and 396 lin. ft. cast iron pipe drains—J. W. Hackney, city engr., 21 city hall.

N. Mex. Santa Fe. 2 pm, Nov. 25.
1.71 mi. Tijeras Canyon Cooperative Forest Aid proj., in Bernalillo co., involving 2,866 cu. yd. class 1, 545 cu. yd. class 2 and 517 cu. yd. class 3 excav., 2,741 cu. yd. class 1 borrow, 276 lin. ft. 18 to 36-in. corrugated metal culvert, etc.—L. A. Gillett, state hwy. engr., Capitol bldg.

N. Y. New York. 2 pm, Nov. 14.
Furnishing 100,000 wood paving blks.—E. F. Boyle, pres., boro of Manhattan.

N. Y. Lockport. 2 pm, Nov. 14.
Improving co. roads as follows: 2.07 mi. road in town of Hartland with bituminous macadam; 2.26 mi. bituminous macadam in town of Royalton; 1.39 mi. bituminous macadam in Royalton; 2.3 mi. concr. road between city and town of Lockport—F. H. Krull, clk., bd. supervrs. courthouse.

N. C. Raleigh. noon, Nov. 18.
21 mi. state hwy. in Lenoir co., involving 6.82 acres clearing and grubbing; 29,650 cu. yd. earth excav.; 89,237 cu. yd. earth borrow, 200,067 sq. yd. concr. or sheet asphalt, or warrenite or topeka pavement; 1,066.11 cu. yd. class A, 212.63 cu. yd. class B and 62.41 cu. yd. class C concr. for structures; 74,877 lbs. reinforcing steel for structures; 1,400 lin. ft. 4-in. tile drain; 402 lin. ft. 6-in. terra cotta pipe, 18 lin. ft. 12-in. pipe and 40,194 ft. drainage ditches—W. S. Fallis, state hwy. engr.

O. Columbus. Nov. 14.
43 mi. new roads of various types of concr., macadam and brick in Adams, Auglaize, Jefferson, Lucas, Morrow, Mercer, Medina, Morgan, Perry, Pickaway and Tuscarawa cos., est. cost \$1,205,050; also bridge in Trumbull co.—State hwy. dept. A. R. Taylor, hwy. comm.

O. Cleveland Heights. noon, Nov. 17.
Grading, draining, curbing and paving with brick, asphalt, concr. or macadam in 2 streets—F. A. Pease Engrg. Co., 805 Marshall bldg., Cleveland

O. Paulding. Nov. 18.
1 mi. Harris and Horn pike road impvt. in Canyall twp.—R. S. Banks, clk., bd. trustees of Canyall twp., Antwerp.

O. Cleveland Nov. 22.
Grading, draining and paving road—W. A. Stinchcomb, co. engr.

O. Euclid. Dec. 8.
Improving 1 mi. road—F. A. Pease Engrg. Co., Marshall bldg., Cleveland.

Okla., Muskogee. Nov. 15.
Gravel surfacing 36 mi. 18-ft. hwy. to cost \$400,000—T. P. Clonts, engr., 2110 Garland ave.

Okla. Tulsa. 2 pm, Nov. 23.
Grading and draining openings in various roads in Tulsa co.—D. V. Patton, co. engr., courthouse.

Pa. Ardmore. 4 pm, Nov. 18.
Grading and macadamizing road for distance of 2,400 ft.—Twp. comr., 75 East Lancaster ave.

S. C. Chester. 3 pm, Nov. 20.
70,000 sq. yd. street paving with drainage and curb—H. S. Jaudon Engrg. Co., Elberton, Ga.

S. Dak. Rapid City. 9 am, Nov. 17.
54,000 sq. yd. portland cement concr. asphaltic concr. bitulithic, sheet asphalt or vitr. blk., paving in 7 small paving districts—T. H. Johnson, constg. engr., Sioux City, Ia.

Tex. San Angelo. 2 pm, Nov. 20.
Hwy. impvg. in Tom Green co., involving 49,510.76 cu. yd. earth excav.; 3,378.53 cu. yd. rock excav.; 59,811.10 borrow; 56.32 acres clearing and grubbing; 49,180.70 cu. yd. crushed stone hauled and spread; 315,117.80 cu. yd. crushed stone hauled additional one-quarter mile; 88,525.20 gal. asphalt; 1,936.16 cu. yd. concr; 72,267 lb. steel, etc.—J. E. Beavers, co. engr.

SEWERAGE.

Cal. San Diego. Nov. 15.
Sewer and water system and fuel oil storage reservoir—Bureau of Yds. and Docks, Navy Dept., Washington, D.C.

Ill. Witt. 8 pm, Nov. 19.
10,000 lin. ft. 8-in., 9,000 lin. ft. 6-in. and 18,000 lin. ft. 4-in. cast iron water mains with connections and fittings—Miller, Holbrook, Warren & Co., 416 Millikin bldg., Decatur.

La., New Orleans. noon, Dec. 15.
Sewerage and water works—F. S. Shields, secy., Sewerage and Water Board.

Mich., Muskegon. 8 pm, Nov. 17.
Main and lateral sewer, involving 2,000 ft. 24-in., 690 ft. 20-in., 1,361 ft. 18-in., 4,101 ft. 15-in., 4,287 ft. 12-in. and 9,568 ft. 10-in. pipe—B. H. Tellman, city recorder.

Neb. Norfolk. 5 pm, Nov. 17.
Water system, involving 7,748 lin. ft. 4-in., 1,820 lin. ft. 6-in. cast iron water main, 16 fire hydrants, 12 brick valve boxes, fittings, etc.—S. R. McFarland, city clk.

N. J. Newark. 10 am, Nov. 25.
Completion of constr. of sect. 2 of outfall pressure tunnel beneath portion of New York bay and Jersey City in Hudson co., N. J.—Passaic Sewerage comrs., Essex bldg., 31 Clinton st.

N. Y., New York. 2 pm, Nov. 14.
Reconstructing sewer in city street—E. F. Boyle, pres., boro of Manhattan

O. Youngstown. noon, Nov. 19.
Sewering various streets—C. F. Ohl, dir. pub. serv.

O. Cleveland Heights. noon, Nov. 17.
Storm and sanitary sewers—F. A. Pease Engrg. Co., 806 Marshall bldg., Cleveland.

Pa., Grove City. Nov. 18.
Sanitary sewer, including 1,184 ft. 8-in. terra cotta pipe, 14 manholes and 2 manhole covers—L. L. McKay, boro secy.

Vt. Burlington. noon, Dec. 22.
Tile underdrain in city street—T. W. Dix, engr.

Wash. Wenatchee. Nov. 24.
Improving avenue by sewers, catch basins, inlets, etc.—City engr.

WATER SUPPLY.

Cal., San Diego. Nov. 15.
See 'Sewerage.'

Colo., Vona. Nov. 15.
Installing water works system and electric light plant—R. D. Salisbury, engr., 1415 East Colfax ave., Denver.

Neb., Randolph. 8 pm, Nov. 30.
Extending water mains (4-in.)—Ray Kirk, clk.

Neb., Norfolk. 5 pm, Nov. 17.
Water system, involving 7,748 lin. ft. 4-in., 1,820 lin. ft. 6-in. cast iron water main, 16 fire hydrants, 12 brick valve boxes, fittings, etc.—S. R. McFarland, city clk.

N. Y., West Haverstraw. 3 pm, Nov. 20.
Water tank and connections, new boiler, etc. at N.Y. State Hospital for Crippled and Deformed Children—L. F. Pilcher, state archt., State Capitol, Albany.

O., Ansonia. Nov. 24.
Installing municipal water and light plant, including two motor drive-pumps of 300 gal. capacity per minute—Vil. clk.

Ont., Toronto. noon, Nov. 18.
Supplying water meters—Works dept., room 12, city hall.

LIGHTING AND POWER.

Fla., Homestead. 8 pm, Nov. 17.
Machinery and equipment for municipal electric light plant—J. Burton, pres., to council.

Ill., Chicago. 11 am, Nov. 14.
Furnishing and installing entire electrical equipment for double-decked bascule bridge over Chicago river—Room 406 city hall.

La., Maquoketa. noon, Nov. 19.
Supplying and erecting one 250 B. H. P. Diesel type engine direct connected to 210 K. V. A. generator with belted exciter, oil tank, pole and line material, switch board and station equipment, meters, transformers, etc.—G. O. Morse, supt. or W. E. Skinner, engr., Lumber Exchange, Minneapolis, Minn.

Minn., Ely. 8 pm, Nov. 18.
Furnishing three 200 H. P. water tube boilers; also one jet condenser with double acting air pump—A. Knutson, city clk.

O., Cleveland. Nov. 14.
Fibre conduit for div. of light and heating—Comrs. Purch. & Supplies.

P. R. Point Borinquen. Dec. 17.
Light station here—Comr. light houses, Washington, D.C.

FIRE EQUIPMENT.

D. C., Washington. 2 pm, Nov. 14.
7,000 ft. 1½-in. double jacket cotton rubber lined, mildew-treated spraying hose, with Albee Kant-slip improved quick hitch couplings and 2½-in. 500 ft. suction hose—Ed. Awards, Dept. Agriculture.

N. H., Franklin. 2 pm, Nov. 14.
Furnishing high power spraying hose and suction hose—Dept. Agriculture, Washington, D.C.

BRIDGES.

Minn. Bemidji. 2 pm, Dec. 5.
Furnishing and installing 30 culverts of corrugated metal on judicial ditch no. 36 and 30 metal culverts on judicial ditch no. 30, average haul 40 mi.—A. D. Johnson, co. aud.

Mich., Lansing. 1.30 pm, Nov. 25.
State reward bridges nos. 4, 10, 41, and 42—F. F. Rogers, state hwy. comr.

O., Circleville. Nov. 17.
Concr. bridge in Washington tw, Pickaway co.—Co. engr.

O., Columbus. Nov. 24.
Asphalt pavement for bridge over Alum creek, involving 950 sq. yd.

MISCELLANEOUS.

D. C., Washington. 10.30 am, Nov. 15.
Furnishing steel, galvanized pipe, copper screening, car wheels, duplex pumps, copper, brass, bronze, bearing metal, lead, etc.—A. L. Flint, gen. purchg. agt., Panama Canal.

D. C., Washington. 10.30 am, Nov. 21.
Furnishing wrought iron pipe, brass tubing, etc.—A. L. Flint, gen. purchg. Officer, Panama Canal.

Ia., Indianola. 10.30 am, Nov. 26.
New channel for Otter creek in Drainage dist. no. 5—A. S. Van Sandt, Clarinda, engr.

Ia., Toledo. Nov. 25.
System of tile lines—V. P. Conkey, Tama co. engr.

Mich., Detroit. 11 am, Nov. 25.
Dredging and rock excav. on Livingstone channel, Detroit river—U.S. Engr. office.

Minn., Waseca. 2 pm, Nov. 22.
Co. ditch no. 19, involving 1,850 ft. 18-in. and 1,900 ft. 14-in. tile, one concr. bulkhead, 2 surface inlets, etc.—T. Peterson, co. aud.

Mo., St. Louis. 11 am, Nov. 17.
120,000 cu. yd. earthwork in East Cape Girardeau and Clear Creek drainage dist., Ill.—Secy, Mississippi River comm., 1311 International Life bldg.

N. Y., New York. noon, Nov. 21.
Dredging in channel between Staten Island and Hoffman and Swinburne Islands, New York harbor—U. S. Engr. office, 39 Whitehall st.

N. Y. Albany. noon, Nov. 25.
Improving state canals as follows: Completing prism excav. between Fairport and King's Bend; completing excav. of canal channel in Genesee river; also constructing barge canal terminals; extension to existing docks at Cohoes; barge canal terminal at Hallet's Cove, boro of Queens, N. Y. C.; furnishing and installing four 2-ton electric semi portal revolving jib cranes on Barge canal terminals, two each at Greenpoint and West 53rd st., N. Y. C.; constructing headhouse and installing water main and electrical work on pier 93, West 53rd st., N. Y. C.—E. S. Walsh, supt. pub. wks., Capitol.

EQUIPMENT BARGAINS

Bulletin No. 270—60 pages—is a

SURE MONEY SAVER

Get it—before buying

Contractors' Equipment, Cars, Rails, Mixers, Engines, Piling, Pipe, Bridges, Tanks.

ZELNICKER IN ST. LOUIS

ELECTRICIAN WANTED

Electrician to take full charge of outside distribution system. Must be A. No. 1 lineman and understand motors. Salary to start \$1,518.00. Nine hours a day. Five and one-half days a week. No lost time. Two weeks vacation per year. Permanent position. The last man held this position twelve years. Address City Manager, City of Grand Haven, Michigan.

The NORTH SEWAGE SCREEN for Clarification

Adapted to Any System. Easy to install. Made to fit individual sewers.

No intercepting sewer needed.

Easy and Cheap to Operate. No extra pumping. Only 2 h.p. No special labor or attention.

Sanitary and Inoffensive. No odor. Solids taken out whole, screenings suitable for fertilizer.

The Green Bay Foundry and Machine Works, Green Bay, Wis.

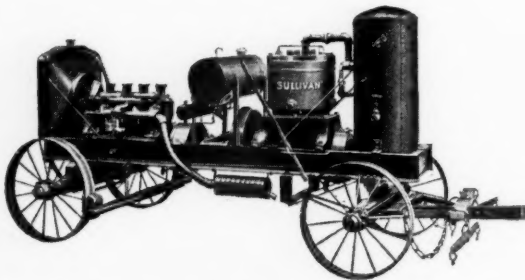
KOEHRING MIXER LOADER



Cuts out all wheelers—makes a worthwhile labor-saving—speeds up the operation of the mixer

THE Koehring Mixer Loader precedes mixer under its own power. Materials are shoveled into bins on the frame, movable along frame. Measures sand and stone by striking off. Bins are adjustable for any proportion of "mix," any capacity of mixer. Materials fed through bottom gate of bins to belt conveyor that carries materials to mixer at speed of 500 feet per minute. Write for catalog.

Koehring Machine Co.
Milwaukee, Wis.



A New Portable Air Compressor

Sullivan Class "WK-31"

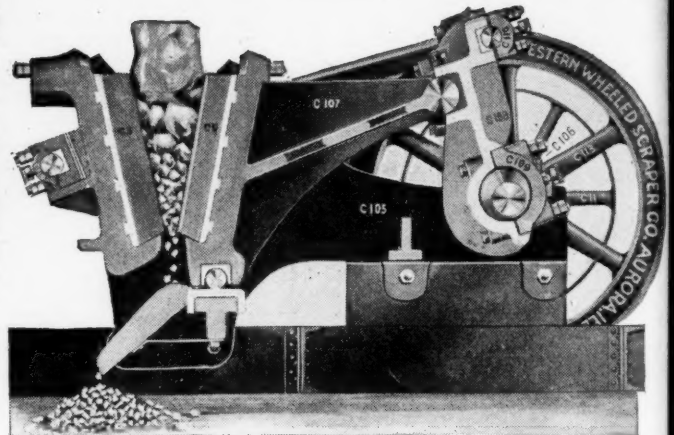
This entirely new Sullivan Model has been designed especially for road and street work, and is simple, rugged and reliable.

The WK-31 consists of a twin cylinder vertical, "wafer" valve Sullivan Compressor, of 150 cu. ft. capacity, for 100 lbs. pressure, operated by direct shaft connection to a heavy duty tractor type, four cylinder gasoline engine; horsepower, 32; weight of outfit, 4300 lbs.

Recommended for operating Sullivan Rotators on all rock excavation.

New Bulletin, 3375-T.

SULLIVAN MACHINERY CO.
122 South Michigan Ave. CHICAGO



The Aurora Rock Crusher

The crusher that strikes two blows on the stone to one of any other make.

The striking feature of the Aurora Crusher is its two-blow stroke to each revolution of the crank shaft. This has three mechanical virtues:

1. It balances the strain and reduces the vibration on the machine.
2. It overcomes the basic objection to all other jaw crushers, viz., that they are only doing effective crushing 50% of each revolution.
3. It turns out more tonnage per horse power than any other jaw crusher of similar size.

AURORA ROCK EQUIPMENT includes:

Revolving Screens
Standard Elevators
Folding Portable Elevators
Stationary and Portable Bins
Gravel Feeding Attachment to Crusher
Dumping Hoppers to feed Elevators
Gravel Screening Plants
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*Write for our special printed matter
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The Austin-Western Road Machinery Co.

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